WHAT IS CLAIMED IS:

1. A tunable laser source comprising

a widely tunable semiconductor laser comprised of an active region on top of a thick, low bandgap, waveguide layer, wherein both the waveguide layer and the active region are fabricated between a p-doped region and an n-doped region; and

an electro-absorption modulator integrated into the semiconductor laser, wherein the electro-absorption modulator shares the waveguide layer with the semiconductor laser.

2. The tunable laser source of claim 1, wherein the semiconductor laser includes a sampled grating back mirror, a phase control section, a gain section, and a sampled grating front mirror.

3. The tunable laser source of claim 2, wherein the waveguide layer is a single common waveguide layer used for the sampled grating back mirror, phase control section, gain section, sampled grating front mirror, and modulator.

4. The tunable laser source of claim 1, wherein the waveguide layer is designed to provide high index tuning efficiency in the laser and good reverse bias extinction in the modulator.

5. The tunable laser source of claim 1, wherein the waveguide is a buried heterostructure waveguide that includes offset multiple quantum wells (MQW) that provide the laser's output.

6. The tunable laser source of claim 1, wherein the waveguide is a ridge waveguide that includes offset multiple quantum wells (MQW) that provide the laser's output.

7. The tunable laser source of claim 1, wherein the waveguide layer includes a blocking junction that blocks lateral current leakage in the laser and reduces parasitic junction capacitance of the modulator.

8. The tunable laser source of claim 1, wherein the semiconductor laser is rapidly tuned over a wide wavelength range by proper adjustment of control currents for the mirrors.

9. A method for fabricating a tunable laser with an integrated modulator, comprising:

(a) performing a first growth step, wherein a buffer layer, a waveguide layer, a stop etch layer, an active region, and a terminating layer are grown on a semiconductor wafer;

(b) patterning and etching the terminating layer and active region down to the stop-etch layer, everywhere except in a gain section of the laser;

(c) patterning and etching of one or more sets of periodically sampled gratings in one or more mirror sections of the laser;

(d) performing a second growth step that completes a vertical structure growth of the terminating layer and a contact layer beneath one or more contacts of the laser;

(e) isolating sections of the laser from one another, and between the modulator and the laser;

(f) patterning the contacts of the laser, removing the contact layer therebetween by etching, and metalizing the contacts;

(g) patterning and etching a ridge waveguide stripe down to either the active region or the waveguide layer and;

(h) cleaving the device out of the wafer, and then applying an antireflective coating on at least one end of the device.

10. The method of claim 9, wherein the laser includes a sampled grating back mirror, a phase control section, a gain section, and a sampled grating front mirror.

11. The method of claim 9, wherein the waveguide layer is a single common waveguide layer used for the sampled grating back mirror, phase control section, gain section, sampled grating front mirror, and modulator.

12. The method of claim 9, wherein the waveguide layer is designed to provide high index tuning efficiency in the laser and good reverse bias extinction in the modulator.

13. The method of claim 9, wherein the waveguide is a buried heterostructure waveguide that includes offset multiple quantum wells (MQW) that provide the laser's output.

14. The method of claim 9, wherein the waveguide is a ridge waveguide that includes offset multiple quantum wells (MQW) that provide the laser's output.

15. The method of claim 9, wherein the waveguide layer includes one or more blocking junctions that blocks lateral current leakage in the laser and reduces parasitic junction capacitance of the modulator.

16. The method of claim 9, wherein the laser is rapidly tunable over a wide wavelength range by proper adjustment of control currents for its mirrors.

17. An article of manufacture comprising a tunable laser with integrated optical modulator fabricated according to the method of claim 9.

18. A method for fabricating a tunable laser with an integrated modulator, comprising:

(a) performing a first growth step, wherein a buffer layer, a waveguide layer, a stop etch layer, an active region, and a cladding layer are grown on a semiconductor wafer;

(b) patterning and selectively etching off of the cladding layer and active region down to the stop-etch layer, everywhere except in a gain section;

(c) patterning and etching of one or more sets of periodically sampled gratings in one or more mirror sections of the laser;

(d) performing a second growth step, wherein an additional growth of the cladding layer is grown to cover one or more periodically sampled gratings in the mirror sections;

(e) patterning and etching a buried ridge waveguide stripe, wherein the waveguide strip is etched laterally to beneath the waveguide layer;

(f) performing a third growth step that completes a vertical structure growth of the terminating layer and a contact layer beneath one or more contacts of the laser;

(g) isolating sections of the laser from one another, and between the modulator and the laser;

(h) patterning the contacts of the laser, removing the contact layer therebetween by etching, and metalizing the contacts;

(i) cleaving the device out of the wafer, and then applying antireflective coatings on at least one end of the device.

19. The method of claim 18, wherein the laser includes a sampled grating back mirror, a phase control section, a gain section, and a sampled grating front mirror.

20. The method of claim 18, wherein the waveguide layer is a single common waveguide layer used for the sampled grating back mirror, phase control section, gain section, sampled grating front mirror, and modulator.

21. The method of claim 18, wherein the waveguide layer is designed to provide high index tuning efficiency in the laser and good reverse bias extinction in the modulator.

22. The method of claim 18, wherein the waveguide is a buried heterostructure waveguide that includes offset multiple quantum wells (MQW) that provide the laser's output.

23. The method of claim 18, wherein the waveguide is a ridge waveguide that includes offset multiple quantum wells (MQW) that provide the laser's output.

24. The method of claim 18, wherein the waveguide layer includes one or more blocking junctions that blocks lateral current leakage in the laser and reduces parasitic junction capacitance of the modulator.

25. The method of claim 18, wherein the laser is rapidly tunable over a wide wavelength range by proper adjustment of control currents for its mirrors.

26. An article of manufacture comprising a tunable laser with integrated optical modulator fabricated according to the method of claim 18.